

Marked-up Version of Amended Claims

1. (Four times amended) A method of food product testing, such method including the steps of

[taking] selecting a sample of a food product having at least one known qualitative property [, the sample including at least one unprocessed foodstuff for preparation of the food product];

preparing the [food] sample for assay [for genomic material of a plurality of target species potentially present in the food product];

assaying the sample, wherein the assay comprises the step of hybridizing genomic material in the sample to a probe matrix having a plurality of target species [contacting the prepared food sample with an array of probes directed to multiple regions of genomic material for each of the plurality of said target species];

forming an output distribution representative of each of the plurality of target species;

storing the output distribution in a database; and

mining the database to correlate the output distribution with [predictive] the at least one known qualitative property.[properties,]

[whereby the genomic material from the plurality of target species present in the food sample selectively hybridizes to the array of probes and the output distribution of target species present is used to predict food quality and processing conditions.]

6. (Once Amended) The method of claim 1, wherein the steps of preparing and assaying further comprise utilizing [carried out by] an automated sample preparation and array testing system.

8. (Once amended) The method of claim 1, wherein the step of preparing the sample includes the steps of recovering a plurality of different microorganisms from the food sample, extracting [DNA] nucleic acids from the plural different microorganisms, and simultaneously amplifying plural target sequences present in the recovered [DNA] nucleic acids for each of said different microorganisms.

9. (Twice Amended) The method of claim 1, further comprising the step of mining the database [correlating the output distribution with a database] wherein the database includes data of at least one type selected from among

(i) other output distributions,

(ii) parameters related to the source, condition or processing of food in the sample from which the output distribution was taken, and

(iii) parameters related to the source, condition or processing of food in the sample from which other output distributions were taken.

14. (Four times amended) A testing method for food quality and processing comprising the steps of

Selecting a sample of a food product having at least one known qualitative property;

preparing an array having a plurality of probes, each probe being directed to [target] sequences [of each of a defined] from a plurality of different target species [wherein the target species include species affecting quality or processing of a food product];

preparing a sample of the food product, wherein the step of preparing a sample includes extracting [DNA] nucleic acids from the sample[, including sequences of the species present in the sample];

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amplifying [treating] the extracted [DNA] nucleic acids with a PCR protocol such that
the target sequences are preferentially amplified[effective to preferentially and simultaneously
increase the level of target DNA sequences of the defined plurality of different target species];

hybridizing the amplified [DNA] nucleic acids to the probes on the array;

forming an output distribution representative of the plurality of target species present in
the sample;

storing the output distribution in a database; and

mining the database to correlate the output distribution with [predictive] the at least one
known qualitative property [properties,

whereby the output distribution of target species present in the food sample can be
correlated to extrinsic parameters so that predictions can be made regarding food quality and
processing].

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REMARKS

The pending Office Action addresses claims 1-6, 8, 9, 14, 17-21, and 23-31, rejecting all of the claims. Applicant herein amends claims 1, 6, 8, 9, and 14 to better define the claimed invention. Applicant respectfully requests reconsideration in view of the amendments and the following remarks.

Independent claims 1 and 14 are amended to recite the step of selecting a food product having at least one known qualitative property. Support for these amendments can be found throughout Applicant's specification, and specifically on page 2, 1st paragraph, line 9; page 6, 3rd paragraph, line 3-6; page 7, 1st paragraph lines 3-5; page 7, 3rd paragraph lines 2-5; page 18, 2nd paragraph, lines 3-5, and page 18, 3rd paragraph, lines 3-12. Claims 6 and 9 are amended to remove any ambiguities in the claim language. In addition, claims 8 and 14 are amended to recite the extraction of nucleic acids rather than DNA. Support for this limitation can be found on page 9, 3rd full paragraph under "System Operation." Accordingly, no new matter has been added by these amendments.

Rejections under prior art

Summary of Applicant's Invention

By way of introduction, Applicant's invention concerns the known qualitative properties of a selected food product. Applicant prepares a distribution which serves to relate genomic material of identifiable microbiological species within this food product with the known qualitative properties. These qualitative properties can include, for instance, smell, color, taste, and pH, though the properties are not limited to these examples. To prepare the distribution, Applicant employs many techniques and elements of microbiological screening and testing that have been used or proposed for clinical, epidemiological or other public health purposes. However, unlike the cited prior art that address food-borne diseases or pathogens, Applicant's invention does not seek to reduce the labor involved in the epidemiological screening of target populations after the outbreak of an illness, or to test for toxins in already processed, warehoused

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or shipped food products, or to simply screen for pathogens. Applicant's probes and method of testing preferably include at least some assays for pathogens, and this factor is perhaps suggestive of the prior art. However, as now more clearly enunciated in the amended claims, Applicant's methods and probes are intended to *correlate known qualitative properties* (e.g., smell, color, taste, pH, etc.) of a food product with a spectrum of target species that may be present in the food product. The target species include species that affect a *known qualitative property* of the food product, and an output distribution is produced such that the distribution enables effective correlation to the known qualitative property.

Thus, Applicant's invention requires a special, food-processing-related palette of organisms, and performs prospective or contemporaneous testing to effect the process. Another claimed distinction is that the claimed invention produces a *distribution* of species present in the food and correlates the distribution with *known food qualities*. The food product oriented distribution, like a spectrograph, intrinsically contains information that, if compiled and correlated with known external events (e.g., source, weather, supplier, historical recall notices), can also be relied on as a test for the external occurrence.

Turning to the Examiner's prior art rejections in the October 1, 2002 office action, Applicant now provides the following remarks addressing the Examiner's specific arguments.

Rejections under Heynecker et al. (U.S. Patent 6,057,100)

Claims 1-6, 8, 9, 14, 17-21, and 23-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Heynecker et al. (hereinafter "Heynecker"), in view of Anderson, Bruckner-Lea et al., Bergeron et al., Nakayama et al., Tauxe, and Megerle for the reasons set forth on pages 4-7 of the October 1, 2002 Office Action. For the following reasons, Applicant respectfully requests reconsideration and withdrawal of the rejection under Heynecker.

Heynecker discloses methods of using oligonucleotide probe arrays, and mentions the use of the oligonucleotide probe arrays in food samples (column 9, line 8) solely in reference to

identifying toxic bacteria. Heynecker does not teach producing a distribution of bacterial species in the food sample or *correlating the bacteria to known food qualities*. Further, Heynecker does not teach a method of forming an output distribution representative of each of the target bacterial species present in the food sample. More importantly, Heynecker does not teach *correlating the distribution to known qualitative properties*, as is required of independent claims 1 and 14.

In contrast, Applicant's invention is directed to the application of various microbiological testing steps to food products to determine a distribution that represents information about the food and *correlate the distribution to known qualitative properties*, not simply to screen and identify a pathogen as is the case with Heynecker. In Applicant's invention, the qualitative properties of the food product are known. The distribution prepared serves to relate genomic material of identifiable microbiological species within this food product with the known qualitative properties. Heynecker does not teach or suggest a method that can be used to correlate both toxic and non-toxic bacterial species to known qualitative food properties (e.g., taste, smell, pH, sliminess, etc.). Rather, Heynecker only addresses the identification of toxic bacterial species in a food product, and is silent as to any correlation between the identification of the toxic bacterial species and the qualitative food properties of the food sample being tested.

Because Heynecker fails to disclose or teach a method of forming a distribution that represents genomic information of microbiological species within a food product, and correlating that distribution of genomic information to qualitative properties that are identified and known of the same food product, as is required of independent claims 1 and 14 of Applicant's invention, Applicant respectfully submits that Heynecker does not disclose or teach the claimed invention.

Furthermore, the deficiencies in Heynecker would not be overcome by its combination with Anderson, Bruckner-Lea et al., Bergeron et al., Nakayama et al., Tauxe, or Megerle, as suggested by the Examiner. While Anderson teaches the use of oligonucleotide arrays in diagnostic applications where data is collected, Anderson fails to disclose the correlation of the data distribution with known qualitative properties of the tested sample. Bruckner-Lea et al.,

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Bergeron et al., and Nakayama et al. all relate to methods for identifying bacteria in a sample using microarrays or probes. Like Anderson, however, they also fail to disclose any correlation between a distribution representing the data gathered and the known qualitative properties of the tested sample. Tauxe teaches surveillance methods to monitor large-scale trends in foodborne diseases using collected data relating to the *processing history* of the food product. Finally, Megerle teaches forming a collection of output distributions that include the present of an organism and its location. Again, both Tauxe and Megerle are silent as to the correlation of the data collected and the known qualitative properties of the sample tested. Since neither of these references address the problem of relating a data distribution of genomic material of microbiological species within a food product to a known qualitative property of the food product, the deficiencies in Heynecker are not overcome by its combination with Anderson, Bruckner-Lea et al., Bergeron et al., Nakayama et al., Tauxe, or Megerle. Therefore, Applicant respectfully urges that the Examiner reconsider and withdraw the rejections under Heynecker.

Rejections under Balch (U.S. Patent 6,083,763)

Claims 14, 17-20, and 23-25 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Balch for the reasons set forth on page 8 of the October 1, 2002 Office Action. Claims 1-6, 8, 9, 14-21, and 23-25 are additionally rejected under 34 U.S.C. § 103(a) as being unpatentable over Balch, in view of Anderson, Bruckner-Lea et al., Bergeron et al., Nakayama et al., and Tauxe as set forth on pages 8-10 of the October 1, 2002 Office Action. For the following reasons, Applicant respectfully requests reconsideration and withdrawal of the rejections under Balch.

Balch teaches that multiplexed molecular analysis can be used to analyze and quantify molecular targets within a sample (column 4, line 30-38). However, Balch only discloses monitoring air, water, and food for microorganisms using a *ribosomal RNA probe-based assay* in which ribosomal RNA of characteristic microorganisms are selectively captured (Example VII). Furthermore Example III and columns 33-37 are believed to be applied to clinical samples or processed products or drug screening, and aimed at after-the-fact pinpointing of the source of

a pathogen or cause of an outbreak, rather than characterizing of a food or adjusting its processing parameters. Further, Balch does not teach correlating the characteristic microorganisms with *known qualitative properties*, as is required of independent claims 1 and 14.

In contrast, Applicant's invention is directed to *nucleic acid based probes* whereas Balch specifically discloses using ribosomal RNA based probes when monitoring food. Additionally, Applicant's invention of multispecies array testing to unprocessed food components in a food processing line, and the use of multispecies distributions to characterize and control food processing, amounts to a method that is conceptually quite different than Balch's after-the-fact screening of populations or finished products to determine what went wrong. Balch is thus silent as to the characterization of a component or ingredient food by determining the distribution of a spectrum of microbiological species (e.g., bacteria or fungi) present in the food, and further steps of responding to the distribution with process steps such as adjusting temperature, pH, flavoring or composition of a food product in preparation, or taking business operation steps, such as identifying harvest conditions, geographic source and other factors for sorting or choosing component food products.

Applicant's invention is directed to the application of various microbiological testing steps to food products to determine a distribution that represents information about the food and correlate the distribution to *known qualitative properties*, not simply to identify microorganisms in food as is the case with Balch. In Applicant's invention, the qualitative properties of the food product are known. The distribution prepared serves to relate genomic material of identifiable microbiological species within this food product with the known qualitative properties. Balch fails to disclose or teach the step of correlating the distribution of information obtained from the food product with known qualitative properties of the food product, as is required of independent claims 1 and 14 of Applicant's invention.

Since Balch fails to disclose the invention as claimed, Applicant respectfully submits that the claimed invention is not anticipated by Balch. Further, the deficiencies in Balch would not

be overcome by its combination with Megerle, Anderson, Bruckner-Lea et al., Bergeron et al., Nakayama et al., and Tauxe, as suggested by the Examiner. As previously discussed, neither of these references address the problem of relating a data distribution of genomic material of microbiological species within a food product to a known qualitative property of the food product. For these reasons, Applicant respectfully requests that the Examiner reconsider and withdraw all of the rejections under Balch.

Rejections under 35 U.S.C. § 112, 2nd paragraph

Claims 1-6, 8, 9, 14, 17-21, and 23-31 are rejected under 35 U.S.C. § 112, 2nd paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant hereby amends claims 1 and 14 to address the Examiner's rejections, and provide the following remarks with respect to the specific objections made by the Examiner with the claim language.

Claim 1 is now amended to delete the terms "foodstuff" and "food sample" in order to eliminate the language objected to by the Examiner. The remaining term "food product" is intended to encompass the common, or dictionary definition of food. As defined by the Merriam-Webster dictionary, the common definition of food is a "material consisting essentially of protein, carbohydrate, and fat used in the body of an organism to sustain growth, repair, and vital processes and to furnish energy." The common definition covers all variations cited by the Examiner. Applicant asserts that "food product" is a broad term, not an indefinite term. One having ordinary skill in the art would understand the broad definition of "food." Applicant respectfully urges that the Examiner reconsider and withdraw this rejection.

Regarding the Examiner's objection to the term "output distribution," Applicant directs the Examiner's attention to page 17, 1st and 2nd full paragraphs in which Applicant recites that "[i]n addition to simply creating an image of the fluorescence intensity of the addresses on the array [detailed above], sampling software converts the output to a user-friendly format, such as a simple bar graph representation of the fluorescence intensity of the species associated with array

addresses...." Furthermore, Figure 1 illustrates a dendrogram, a representation of the distribution of the species in the sample of a food product. Therefore, Applicant believes that the specification adequately defines output distribution for one having ordinary skill in the art.

The phrase "mining a database," a comparative process, is detailed in the Applicant's specification. Claims 1 and 14 have been amended to recite "mining the database *to correlate* the output distribution with the at least one known qualitative property." As discussed on page 17, last paragraph through page 18, mining is a process in which "the user may compare the different parameters of the sample with similar samples in the database." The specification gives examples of how such a comparison may be carried out, *e.g.*, superimposition of the population profile onto a landscape of parameters.

Claims 1 and 14 are amended to remove the phrase "predictive qualitative properties" to eliminate the language objected to by the Examiner. Furthermore, Applicant amends the claims to recite instead "known qualitative property." Claim 26 recites that "the qualitative properties are selected from the group comprising smell, texture, organoleptic properties, and taste." Claim 28 recites that the "processing conditions are selected from the group comprising quality and source of a component, flavor potential, and shelf-life." In addition, Applicant defines "extrinsic parameters" as, for example, conventional records of batch lot numbers, ingredient invoices, product returns, later-reported or later-detected contaminants, processing conditions, food component source, taste, color or other quality checks (page 7, 1st paragraph; page 6, 2nd paragraph; page 18, 3rd paragraph). Similarly, "food safety" is a qualitative property that is intended to be encompassed by the "known qualitative property" recited in amended claims 1 and 14. With respect to the Examiner's comment on page 12 of the October 1, 2002 Office Action, that "there is no indication what these [qualitative] are or nor how they are measured," Applicant respectfully asserts that measuring or analyzing these "known qualitative properties" is not necessary to the interpretation of the claimed invention. Applicant's invention is directed to *correlating* these *known* qualitative properties to an output distribution. The exact parameters

get applicant to accept that these qualities are a limitation

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or standards used to measure these properties are not required to appreciate Applicant's invention.

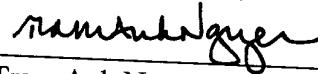
By these amendments, Applicant has removed the language objected to by the Examiner. Applicant believes these amendments satisfy all of the Examiner's concerns. The Examiner is kindly asked to reconsider and withdraw these rejections.

In view of the above, each of the presently pending claims 1-6, 8-9, 14, 17-21, and 23-31 in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejections of the claims and to pass this application to issue. In the event that the amendments and remarks are not deemed to overcome the grounds for rejection, the Examiner is kindly requested to telephone the undersigned representative to discuss any remaining issues.

Respectfully submitted,

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